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PROCEDURES TO DETECT WHEAT SEED GALL NEMATODE (*ANGUINA TRITICI*) SHOULD AN INFESTATION APPEAR IN FLORIDA.

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INTRODUCTION: Wheat seed gall nematode, *Anguina tritici* (Steinbuch, 1799) Chitwood, 1935 (Fig. 1) is considered an economically important pest of wheat (*Triticum* spp.), and rye (*Secale cereale* L.). It is subject to regulatory action should it arrive in Florida where it is not known to occur.

In areas where it is established, *A. tritici* causes a disease called cockle, gout, purples or false ergot. Under poor and substandard agricultural conditions of some undeveloped countries, the disease has destroyed 30-70% of the wheat crop (1) in some instances.

Exotic pest detection is one of the primary mandates of the Division of Plant Industry. Early detection of an exotic pest can result in a relatively inexpensive eradication program. Late detection, by contrast, can culminate in a very expensive eradication undertaking, or in the very worst outcome, fail, allowing an exotic pest to become a permanent part of the Florida flora or fauna, causing an additional economic burden to affected growers.

The object of this circular is to provide means for early detection of wheat seed gall nematode. An earlier circular (4) provides additional biological data concerning seed gall nematodes.

KNOWN DISTRIBUTION: USA: California, Georgia, Maryland, New York, North Carolina, Virginia and West Virginia. World (2): Australia, Austria, Brazil, China, Egypt, England, Ethiopia, France, Germany, India, Italy, Hungary, Netherlands, New Zealand, Pakistan, Rumania, Sweden, Switzerland, Syria, Turkestan, U.S.S.R., and Yugoslavia.

SYMPTOMS: (Wheat) (1) (2) (5). Wheat seed gall nematodes infect aboveground plant parts invading and becoming endoparasitic in the plant tissue.

LEAVES: (Fig. 2): Symptoms usually appear in wheat seedlings and are most noticeable just prior to seed heading. Leaf margins buckle and crimp, and then leaves become wrinkled, twisted, and rolled up. Galls (small swellings) may appear on or near the leaf midrib. Leaves lose color, turn chlorotic, wilt, and the seedling may perish.

In field surveys one might encounter similar symptoms caused by the stem and bulb nematode, *Ditylenchus dipsaci* (Kuhn, 1857) Filipjev, 1936. This pest engenders a condition called tulip root which could be confused with seed gall nematode seedling distortion. Tulip root is characterized by a swelling near the plant base (as an inverted tulip) and discolored stem and leaf areas. Fortunately, this very serious pest is also not established in Florida. If tulip root symptoms are observed in a seed gall nematode survey, samples should be collected and submitted to the Nematology Bureau.

STEM: Infected stems become enlarged (thick), distorted, with shortened internodes. Bending or stem crooking may also occur.

SPIKES: Infected spikes (Fig. 3) are stunted, thickened, and stay green longer than healthy spikes. Glumes are spread apart by the diseased seed galls, exposing the galls which can easily be observed by inspection. One, several, many or all seeds in a spike may be infected. At maturity, glumes assume a dirty brownish color.

SEEDS: About 112 days following infection, the nanoid dark green wheat seeds turn a purplish brown, changing with age to brown then black (3). Infected rye seeds are straw colored. The thick-walled abnormally small seed galls (Fig. 4, left) are variable in shape measuring 1/8 - 3/16" (3.2 - 4.8 mm) long by 1/6 - 1/8" (4.2 - 3.2 mm) wide. If cut or crushed, a white mass will be found inside comprised of nematode bodies averaging 29,000/gall (3); large galls may contain up to 90,000 nematodes.

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If bulk threshed grain is inspected the abnormal dark galls are easy to spot providing there are a sufficient number of infected galls present. Some contaminants in wheat kernels resemble nematode galls. The following are some common contaminants with differentiated characteristics:
Smut balls - Easily crush between fingers, producing a black powder. A brush is present at the tip of the ball.
Cockle seed - Black, rounded, covered with spines.
Vetch seed - Rounded, smooth, uniform color.
Ergot sclerotia - (*Claviceps purpurea* Fr.), elongate fungal bodies.

The nematode seed gall is the only gall or gall-like structure that contains a white mass of nematodes inside. Seed certification programs and modern seed cleaning techniques have, fortunately, reduced drastically the incidence of seed gall contaminated grain.

TARGET SITE SELECTION: Primary target sites are plantings of wheat or rye, initially in North Florida and near the Georgia line. Wheat fields planted adjacent to normal work travel routes should be randomly inspected and samples taken if wheat gall nematode symptoms are suspected.

TARGET HOST SELECTION: Seed gall nematodes have a rather limited host list. Wheat and rye would be the principal target hosts in a survey. Hosts of wheat seed gall nematode include:

Triticum aestivum L. (wheat)
Triticum monoccum L. (einkorn)
Triticum turgidum L.
Aegilops ventricosa Tausch
Holcus lanatus L. (velvet grass)
Phleum pratense L. (Timothy)
Avena sativa L. (oats) poor host
Hordeum vulgare L. (barley) poor host
Secale cereale L. (rye)

NEMATODE DISEASE COMPLEX: Two diseases are associated with wheat seed gall nematode. *Corynebacterium tritici* (Hutch.) Burk. (yellow ear rot disease of wheat) characterized by a bright yellow slime on the spike. *Dilophosphora alopecuri* (Fr.) Fr. (dilophosphorosis of wheat) characterized by the spike enveloped in a sticky black mass. Since both diseases are rarely seen without the nematode, both diseases should be considered target indicators in surveys.

SURVEY PROCEDURE: Seedlings: Walk about field perimeter and look for patches of stunted chlorotic deformed seedlings (see leaf and stem symptoms). A small depressed area showing symptoms of wheat gall nematode may be seen quite some distance from the edge to deep into the field. Place whole malformed plants from such sites in a plastic bag for laboratory examination.

Plants with mature spikes: Examine spikes on plants at the perimeter of the field and inside the field. (See spike symptoms.) If galled or diseased spikes are encountered, collect specimens and submit them to the Nematology Bureau. If no symptoms are observed, no foliage samples need be taken. Whenever possible, take a 5-plug (one sample) nematode soil sample from each field surveyed to check for exotic pests in the soil.

Bulk seed: Take about a one cup subsample from the seed, pour on to a flat tray and look for black or brown galled seed. If negative, repeat with at least one more subsample.

REFERENCES

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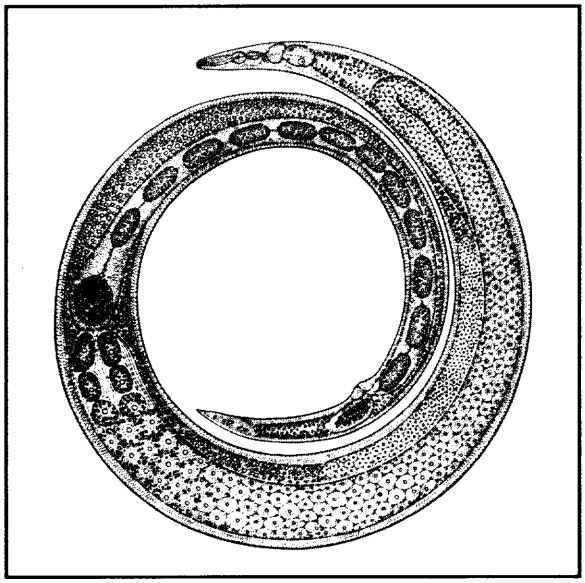

Fig. 1. A female wheat seed gall nematode. (After Thorne)

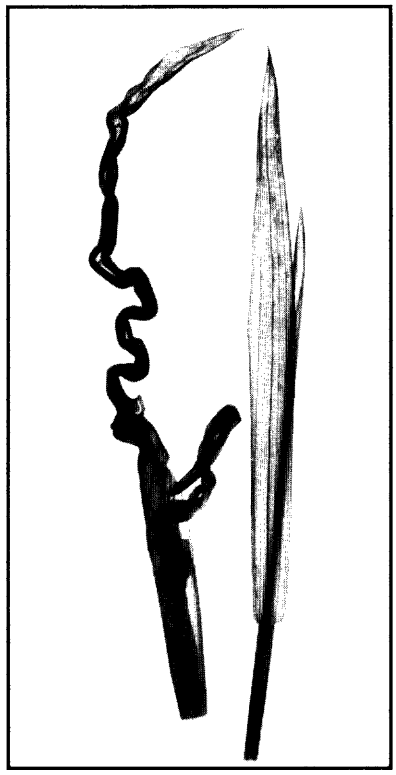

Fig. 2. *Anguina tritici* symptoms on wheat seedlings. Left: deformed, twisted nematode-infected leaf. Right: noninfected leaf.

Fig. 3. Wheat seed gall nematode-infected spike. Note open glumes and dark seed in center spikes.

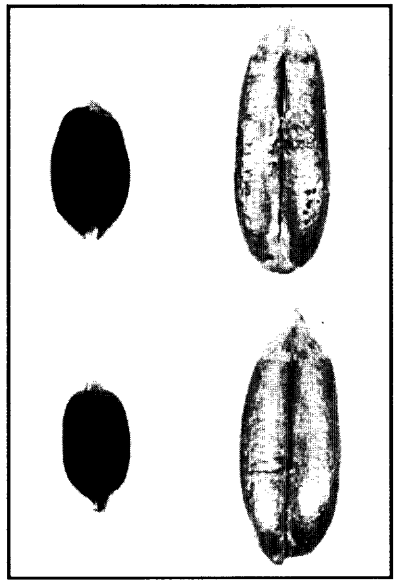

Fig. 4. Wheat seed. Left: galls infected with *A. tritici*. Right: noninfected seed.

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